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Majorana fermions in a superconductor quantum wire connected to normal leads[1] EDSON VERNEK, Federal University of Uberlândia, ANTÔNIO C.F. SERIDÔNIO, Universidade Estadual Paulista Júlio de Mesquita Filho, JOSÉ C. EGUES, Instituto de Física de São Carlos - USP — We study the appearance of Majorana fermions in a quantum wire connected to a normal lead. We employ a Kitaev model for the wire with induced superconductivity with a full coupling with a normal wire. In comparison with previous study of this problem, our approach has the advantage of allowing us to fine tune the Kitaev Hamiltonian model all the way from its normal to its superconducting topological phase. By developing an exact Green's function calculation scheme, we are to explore the full parameter space of the model via analysis of the electron and the Majorana density of states. Our results show clearly that the main effect of a particle-hole symmetric lead is the broadening of the Majorana density of states at the end of the wire, while particle-hole asymmetric leads are detrimental to the Majorana bound states. We also study the transmission through a quantum dot connected to two normal leads and to a superconducting wire. We show that by driving the wire from its normal to its topological phase, a great change in the transmission function through the dot is observed, clearly indicating the emergence of a Majorana mode in the wire. Although such a signature has already been predicted in recent works, our model leads to substantially different results.

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